ENSC-308: WATER AND WASTEWATER TREATMENT (THEORY) (02 Credit hrs

PRE-REQUISITES: ENSC-304

LEARNING OUTCOMES

- Students will understand various types of methods and technologies employed in wastewater treatment
- Students should be able to select an economical and effective wastewater treatment system for a specific application
- At the end of the course, the students will have a working knowledge of the water and wastewater industry, and have the skills to perform a preliminary design of a treatment plant

CONTENTS

The aim of this course is to introduce the students to the area of water and wastewater treatment. The course is meant to provide a broad theoretical and practical foundation of various wastewater treatments. The course also teaches the configurations, design and operation of relevant wastewater treatment processes, including physical, chemical and biological methods.

Unit-1: Introduction to Wastewater Treatment

1.9. Definition and levels of wastewater
1.10. Water Treatment Philosophy
1.11. Importance and goals of wastewater treatment
1.12. Evaluation and Selection of Treatment Systems

Unit-2: Wastewater Characterization

2.9. Domestic and industrial wastewater
2.10. Wastewater collection systems
2.11. Wastewater flow rates and Flow Equalization
2.12. Measurements and monitoring discharge

Unit-3: Wastewater treatment methods

3.9. Preliminary Treatments, Primary Treatments, Secondary Treatments, Tertiary Treatments
3.10. Trickling Filters, Activated Sludge Tanks, Oxidation Tanks, Constructed Wetlands
3.11. Anaerobic, suspended, and attached growth biological treatment processes
3.12. Adsorption, Chemical unit processes, Disinfection processes, disposal of solids, Treatment plant performance, Advanced oxidation processes

Unit-4: Re-use and recycling

4.9. Wastewater reuse guidelines, ZLD
4.10. Technologies, practices and examples: feasibility in Pakistan
4.11. Case studies of wastewater recycling; grey water reuse
4.12. Cost and economics analysis

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weight age of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

15. SpringerLink (Online service), Inamuddin, Ahamed, M. I., & Lichtfouse, E. (2021). *Water pollution and remediation: Organic pollutants*. Springer.
16. ProQuest Ebook Subscriptions, Rene, E. R., Shu, L., & Jegatheesan, V. (2020). *Sustainable eco-technologies for water and wastewater treatment*. IWA Publishing.
17. Pandit, A. B., & Kumar, J. K. (2019). *Drinking water treatment for developing countries: Physical, chemical and biological pollutants*. Royal Society of Chemistry.
18. Chen, J., Luo, J., Luo, Q., Pang, Z., & Group, C. E. P. (2018). *Wastewater treatment: Application of new functional materials*. China Environment Publishing Group ; Walter de Gruyter.
19. Woodard & Curran, Inc., Books24x7, Inc., & Woodard, F. (2006). *Industrial waste treatment handbook, second edition* (2nd ed.). Elsevier/Butterworth-Heinemann.
20. Metcalf & Eddy, Tchobanoglous, G., Burton, F. L., & Stensel, H. D. (2003). *Wastewater engineering: Treatment and reuse* (4th ed.). McGraw-Hill.

ENSC-308: WATER AND WASTEWATER TREATMENT (PRACTICAL) (01 Credit hr.)

PRE-REQUISITES: ENSC-304

LEARNING OUTCOMES

- This laboratory-based course will provide a demonstration about the different treatment methods for the removal of pollutants from water/wastewater

CONTENTS

This laboratory course is designed to provide practical aspects of wastewater treatments. It will also enable students to learn about the evaluation techniques and testing procedure for the assessment and remediation of major pollutions in water and wastewater. Student will know the sound knowledge about calculating pollution load in any given effluent.

Unit-1

1.3. Physio-chemical treatments (coagulation, flocculation, settling, flotation, adsorption, membranes)

Unit-2

2.1. Color/COD/BOD/TSS removal of industrial and synthetic effluents using cheap absorbents, such as ash, charcoal, wood, saw dust, brick powder, etc.

Unit-3

3.1. Wastewater Treatment methods based on Microfilteration, Ozonation, Fenton, Electro-coagulation, and Reverse osmosis

Unit-4

4.1. Determination of wastewater flow rate (V-notch study)

Unit-5

5.1. Pollution load determination in wastewater

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

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